Report on the growth and status of the New Zealand hydrogen ecosystem – 2022

This report is the first in a series of yearly updates on the growth and status of the hydrogen ecosystem in Aotearoa New Zealand, written by GNS Science as part of the Aotearoa: Green Hydrogen Technology Platform research programme funded by the New Zealand Ministry of Business, Innovation, and Employment.

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International context

According to the International Energy Agency (IEA, 2021), the first recommendation for near-term action on global hydrogen development is for nations and industries to develop roadmaps and strategies outlining how hydrogen can play a role in the future energy mix.

The transition from old products and technologies to new ones, particularly in the eco-innovation sectors, can have strong environmental and social benefits that may not have equally favourable economic or business cases. Therefore, it is due to anticipation in changes to government regulations and future changes in market forces that new technologies receive investment from Industry (Bakker and Budde, 2012). Agencies like GNS Science engage with stakeholders to understand a complete picture of these new technologies.

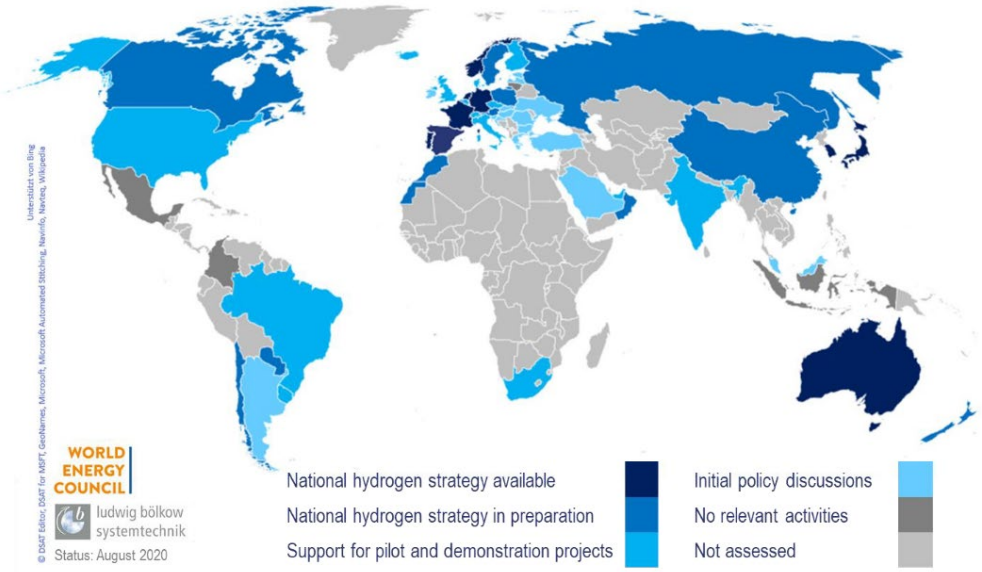

Figure 1 – Status of international hydrogen activities of national governments as of August 2020. (World Energy Council, 2020)

In countries where government roadmaps and strategies have been released, the private sector has increased its commitment to Hydrogen projects, particularly in regions such as Europe, Asia, and Australia, as shown in figure 1. For example, Fortescue Future Industries (FFI) based in Australia has been aggressively promoting and expanding its investment in Green Hydrogen in Australia to decarbonise the mining and other sectors (FFI, 2022).

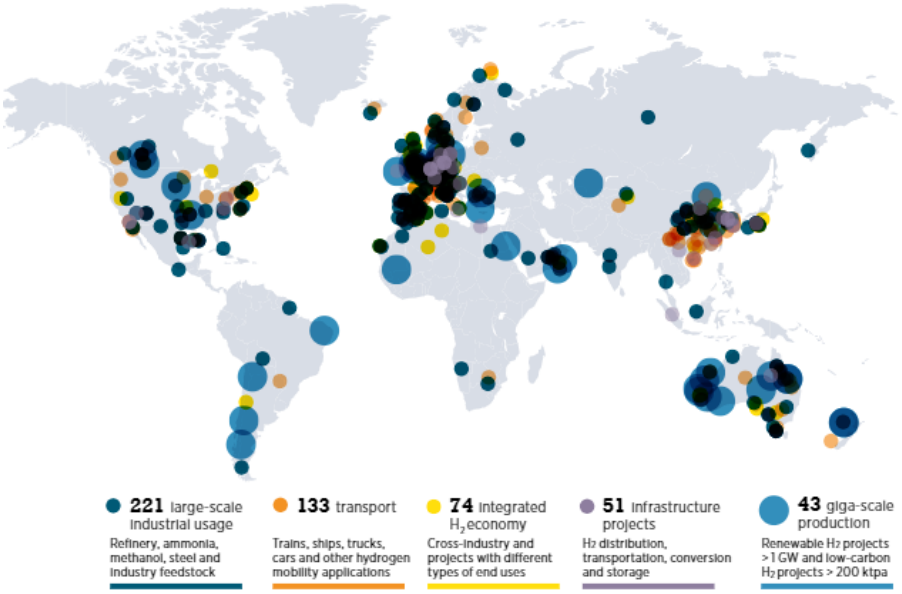

Figure 2 – Global hydrogen projects and investment across the value chain, concentrated in North America, Europe, and Asia as of November 2021. From International Renewable Energy Agency (IRENA, 2022).

To date, there have been greater than US$500 billion in announcements for global projects, with approximately US$80 billion considered "mature" (Hydrogen Council, 2021). The expected capacity by 2030 has therefore increased significantly (see figure 3). It is now projected that 260 GW (up from 69 GW July 2021) of capacity has been announced, which is a 500% increase in capacity between February 2021 and January 2022. This represents an additional 475 GW of renewable capacity required globally (IRENA, 2022). For example, In Europe, which has strong policies and government support, Shell launched its largest hydrogen project in Germany with a 10MW capacity in July 2021, with a total cost of approximately 20 million euros (Reuters, 2021). Its next project will be 100MW in size, and electrolyser manufacturers, such as Cummins, are scaling up their manufacturing to meet these needs (Cummins, 2020).

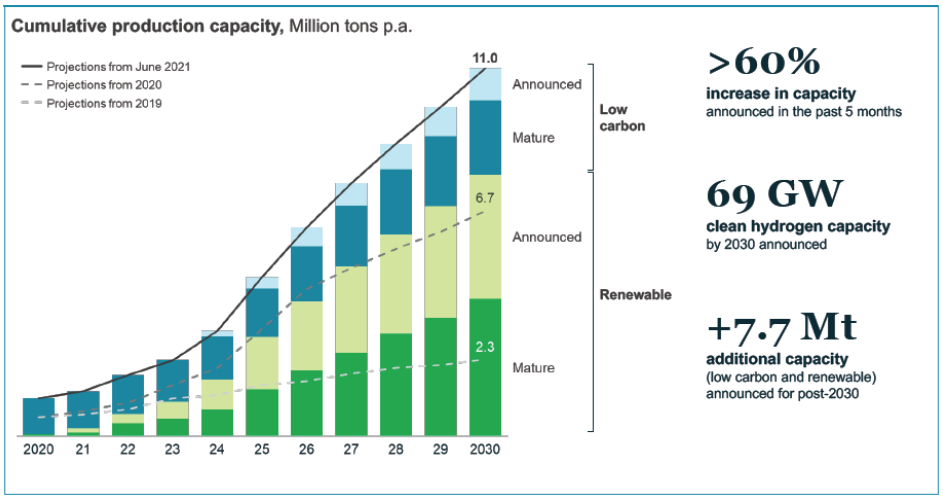

Figure 3 – Announced clean hydrogen capacity through 2030 showing significant industry growth. Taken from Hydrogen Council report (2021).

In Aotearoa New Zealand, the Rio Tinto aluminium smelter at Tiwai Point, which uses 13% of Aotearoa's electricity and whose contract currently expires at the end of 2024, presents a compelling opportunity to be one of the world's first large-scale green hydrogen production projects with an internationally competitive price point (Contact, Meridian, McKinsey and Co, 2021). As well as being a major source of green hydrogen for industry, GH_2 produced at scale may also help provide a solution to NZ's dry-year problem, where years with below-average rainfall result in a deficit of renewable generation and higher carbon emissions. A final investment decision from Contact and Meridian is expected in late 2023 (Business NZ: Exploring New Zealand's Hydrogen Potential, 2021).

New Zealand and regional roadmaps and projects

An effective energy transition requires foresight and planning between macro-actors in the private and public domain, to achieve short and long-term ecosystem development. New industries require government guidance and investment to support a new industry (Farla et al., 2012), where National institutions such as GNS Science playing a key role in early technological development.

In September 2019, The Ministry of Business, Innovation & Employment (MBIE) released its green paper "A Vision for Hydrogen in New Zealand" with a consultation process that ended in October 2019. An updated version of a hydrogen strategy is tentatively due to be released in early 2022 (MBIE, 2021). Moreover, MBIE has established a "Just Transitions Unit" for energy, which since 2018 has been working in various regions within NZ to create and support new opportunities and understand the impact on different communities and sectors (MBIE, 2018). At a regional level within New Zealand, there is considerable variation in how development agencies see the use of hydrogen within their respective areas.

Taranaki

The Taranaki region is home to a large portion of NZ Energy producers and has shown effective leadership in the energy transition. Its regional development agency, Venture Taranaki, has released a series of energy transition related reports including their Roadmap to 2050 report, H2 Taranaki Roadmap, and Offshore Wind (Venture Taranaki, 2021). The region also hosts Are Ake as a National Energy Centre that is focused on Energy Innovators and provides assistance in commercialising energy solutions (Ara Ake, n.d.). Private organizations, such as Firstgas Group, have also released feasibility studies for the transition to 100% Hydrogen across their networks (2020), despite recent delays in the testing and initial pilots within their network (Stuff, 2021) we look forward to future developments in existing gas infrastructure.

The most recent report from Venture Taranaki entitled "Power to X" based on the well-known term, highlights the opportunities for NZ to create a green energy ecosystem, by producing green products from clean energy, encompassing hydrogen and its derivatives for use both domestically and to drive exports. Moreover, Polytechnics such as the Western Institute of Technology Taranaki have recognized the need for training and are shifting to new GH_2 curriculums

Taranaki is well-positioned to leverage its existing knowledge from its history as an Energy hub through connections, infrastructure and a skilled workforce to take a leading role as the industry develops.

Southland

Southland is another region that has taken a leading role in decarbonisation, with green hydropower being available via Manapouri powering the Tiwai Point Smelter. Along with 600MW of base-load Hydro generation, existing high voltage transmission with land, water and a deep-water port combine to make this an excellent opportunity. Its regional development agency, Great South, has

been actively engaged with stakeholders to execute its decarbonisation strategy; companies such as Meridian and Contact commissioned a Report by McKinsey & Co. entitled: The New Zealand Hydrogen Opportunity. Local iwi, such as the Murihiku Regeneration (Ngai Tahu), which comprises multiple local hapū and iwi, is actively working on the regional Hydrogen ecosystem by through active projects to develop Regional tourism and bus transport between Queenstown and Te Anau (Murihiku Regeneration, 2021).

Other regions

While not having publicly released roadmaps or strategies from their respective development agencies or councils, other regions across the country are progressing initiatives that contribute to our hydrogen ecosystem. This includes the 'Christchurch Hydrogen Collective' which consists of organizations such as the Christchurch City Council, International Airport, and Fabrum for liquid Hydrogen storage. Ports of Auckland, with its large GH_2 investment and refuelling demonstration site, and research and innovation actors including all major Universities have existing GH_2 capabilities. In the transport sector, Hiringa Energy (based in New Plymouth) are prioritizing heavy transport by building New Zealand's first Hydrogen refuelling network in partnership with Waitomo Group across the North Island, while Gallagher Fuel Systems based in Marton are designing the future of fuel dispensing solutions.

Stakeholders

Macro factor	Stakeholder
Political/Policy	MBIE Just Transitions Unit EECA Hydrogen Council Regional and city councils
Economic	Contact / Meridian Halcyon Power Hiringa AF Cryo Ballance Agrinutrients Air New Zealand Emirates Team New Zealand Ports of Auckland, Port Taranaki, Ports of Tauranga
Social	Iwi and hapū including Ngāti Tāwhaki hapū in Ruatoki Murihiku Regeneration Local community groups
Technological (Research, Commercialisation)	GNS Science Universities of Otago, Canterbury, Auckland, Waikato, Victoria Are Ake Polytechnical Institutes Callaghan Innovation

Table 1 –Although not an exhaustive list, a sample of primary actors in the New Zealand Hydrogen Ecosystem

New Zealand's hydrogen ecosystem, compared to our potential, is still in its infancy but is showing a promising future as new technologies develop and new organizations enter the market. There are currently actors that exist that span the Political, Economic, Social, and Technological (PEST) spectrum, outlined briefly in Table 1. This shows that with stakeholders across each category, there is a significant expertise to deploy more pilot projects and continue with further research activities to solve major technical challenges on the path to decarbonisation.

Current NZ projects

Through various partnerships and funding mechanisms, there are numerous projects being undertaken around the country. Here is a list of significant projects:

- Contact Energy and Meridian have progressed to Requests for Proposals to develop the world's largest green hydrogen plant, by repurposing approximately 600 MW of high capacity factor electricity generation which supplies the Rio Tinto aluminium smelter at Tiwai Point, Southland. The plant is scheduled to close in December 2024
- A partnership between Tuaropaki Trust and Obayashi Corporation (Halcyon Power) to demonstrate hydrogen production from geothermal electricity with the opening of a 1MW electrolyser plant in December 2021
- Announcement by Air New Zealand of a partnership with Airbus to assess hydrogen viability for its fleet
- Development of a refuelling network by Hiringa for heavy transport primarily in the transport corridors of the North Island, along with the supply of Hydrogen fuel cell trucks from Hyzon Motors
- A partnership between Hiringa Energy and Ballance Agrinutrients to produce green ammonia from Hydrogen produced by wind turbines
- Te Anau Hydrogen Bus project, running between Queenstown and Milford Sound, undertaken by the Murihiku Regeneration and other partners
- An electrolyser and refuelling station at the Port of Auckland, which has plans to be a zero emissions port by 2040

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